2010

American Petroleum Institute Research Project 44: Description and Analysis

Richard E. Voeltz
University of Nebraska - Lincoln, rvoeltz1@unl.edu

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History

The American Petroleum Institute, in cooperation with the National Bureau of Standards, initiated its Research Project 44 in 1942. The project was designed to provide reliable information on the thermodynamic and thermophysical properties of selected hydrocarbons and their sulfur-containing derivatives. This information was needed to support the massive demand for fuel, lubricants, and other petroleum products during World War II. The tables containing this information were originally produced in loose-leaf form for refineries, chemical companies, and universities. The tables were subsequently issued in book form in 1948. A newer edition, Selected Values of Physical and Thermodynamic Properties of Hydrocarbons and Related Compounds, provided tables produced through December 31, 1952. The project moved from the National Bureau of Standards to Carnegie Institute of Technology in June, 1950.

Source: **http://www.boulder.nist.gov/div838/trc/history.html**
Physical and Chemical Properties Division, TRC Group

Structure of the Tables

The Project 44 tables contain data on physical and thermodynamic properties of hydrocarbons. Hydrocarbons are divided into 44 sections, represented by numbers in the titles of the tables. The sections with corresponding numbers are as follows:

00	O, H. N. C
0	O2, H2, OH, H20. N2, NO, C, CO, CO2
1	Paraffins, C1 to C5
2	Paraffins, C6 and C7
3	Paraffins, C8
4	Paraffins, C9
5	Alkyl benzenes, C6 to C9
6	Alkyl cyclopentanes, C5 to C7
7	Alkyl cyclohexanes, C6 to C8
8	Monoolefins, C2 to C6
9	Monoolefins, C7
10	Monoolefins, C8
11	Diolefins, C3 to C6
12	Acetylenes, C2 to C5
13	Styrenes, C8 and C9
14	Alkyl benzenes, C10
15	Alkyl cyclopentanes, C8
17	Paraffins, C10
18	Alkyl cyclopentenes, C5 to C7
19	Alkyl cyclohexenes, C6 to C8
20	Normal paraffins, C1 to C40
21	Normal alkyl benzenes, C6 to C42
22	Normal alkyl cyclopentanes, C5 to C41
23	Normal alkyl cyclohexanes, C6 to C42
24	Normal monoolefins (1-Alkenes), C2 to C40
25	Normal acetylenes (1-Alkynes), C2 to C40
26	Alkyl benzenes, C11
27	Naphthalenes, C10 to C12
28	Tetrahydronaphthalenes, C10 to C12
29	Decahydronaphthalene, C10 to C12
30	1-Normal alkyl naphthalenes. C10 to C12
31	2-Normal alkyl naphthalenes, C10 to C12
101	Normal 1-alkanethiols, C1 to C20
102	Normal 2-alkanethiols, C1 to C20

103	Alkanethiols, C1 to C5
104	Alkyl benzenethiols, C6 to C8
105	2-Thiaalkanes, C2 to C20
107	Thiaalkanes, C2 to C5
108	Thiaalkanes, C6
109	Alkyl (1-thioalkyl) benzenes, C7 and C8
110	Alkyl (1-thioalkyl) benzenes, C9
111	Alkyl thiacyclopropanes, C2 to C4
112	Alkyl thiacyclopentanes, C4 to C7
113	Alkyl thiacyclohexanes, C5 to C7
114	Alkyl thiophenes, C4 to C6
115	Alkyl thiophenes, C7 .

Physical properties of the hydrocarbons in the tables are designated as Greek or Latin letters:

Alpha	Values of fundamental constants
Beta	Conversion factors
Gamma	Useful equations with numerical constants
Delta	Molecular weights of hydrocarbons
a	Boiling points (degrees C), dt/dp (degrees C/mm Hg), refractive index, density (g/ml), and freezing point (degrees C)
a-E	Boiling point (degrees F), dt/dp (degrees F/in Hg), refractive index, density (lb/cubic foot and lb/ gallon), specific gravity (60 degrees F/60 degrees F), and freezing point (degrees F)
b	Molecular volume (ml/mole), molecular refraction (ml/mole), specific refraction (ml/g), refractivity intercept, and specific dispersion (ml/g)
c	Viscosity (absolute) (centipoises), at temperatures in degrees C

c-E	Kinematic viscosity (centistokes), at temperatures in degrees F
c-K	Kinematic viscosity (centistokes), at temperatures in degrees C
d	Density (g/ml), at temperatures in degrees C
d-E	Density (lb/cubic foot), at temperatures in degrees F
e	Surface tension (dyne/cm), at temperatures in degrees C
i	Critical temperature (degrees K, degrees C, degrees R, and degrees F), critical pressure (atm and lb/ square inch), critical density (g/ml, lb/cubic foot), critical volume (liter/mole and cubic feet/lb mole)
k	Vapor pressures (mm Hg) and boiling points (degrees C) at 10 to 1500 mm Hg
k-E	Vapor pressures (lb/sq. in.) and boiling points (degrees F) at 0.2 to 39 lb/sq. in.
m	Heat of vaporization (kcal/mole, cal/g, and BTU/lb) and entropy of vaporization (cal/degree mole) at 25 degrees C and the normal boiling point
n	Heat of combustion (kcal/mole, cal/g, and BTU /lb) at 25 degrees C
p	Heat of formation (kcal/mole), entropy (cal/degree

mole), and free energy of formation (kcal/mole) at 25 degrees C

q Standard heat of vaporization (kcal/mole), entropy of vaporization (cal/degree mole), and free energy of formation (kcal/mole) at 25 degrees C

r Heat content function (H degrees – H degrees 0)/T, (cal/degree mole) at 0 degrees to 1500 degrees K

s Free energy (F degrees – H degrees 0)/T (cal/degree mole) at 0 degrees to 1500 degrees K

t Entropy, S degrees (cal/degrees mole) at 0 degrees to 1500 degrees K

u Heat content (H degrees – H degrees 0)/T, (cal/mole) at 0 degrees to 1500 degrees K

u-E Heat content, H degrees – H degrees 0, (BTU/lb) at -459.69 to 2200 degrees F

u-G Heat content, H degrees – H degrees 0, (cal/g) at -273.16 to 1200 degrees C

v Heat capacity, C /subscript/p degrees, (cal/degree mole) at 0 degrees to 1500 degrees K

v-E Heat capacity, C /subscript/p degrees, (BTU/lb degrees F) at -459.69 to 2200 degrees F

v-G Heat capacity, C /subscript/ p degrees, (cal/g degrees C) at -273.16 to 1200 degrees C

w Heat of formation, delta H f degrees, (kcal/mole) at 0 degrees to 1500 degrees C

x Free energy of formation, delta F f degrees, (kcal/mole) at 0 degrees to 1500 degrees K

y Logarithm of equilibrium constant of formation, log base 10 Kf, at 0 degrees to 1500 degrees K

z Heat of fusion, (kcal/mole), entropy of fusion (cal/degree mole), freezing points (degrees C and degrees K), and cryoscopic constants (degrees to the minus 1)

Index of Properties

Physical and thermodynamic properties of hydrocarbons in the tables are referenced by Greek or Latin letter and page number, indicating the section and location of table, respectively.

Index of Compounds

Classes of compounds are listed alphabetically as main heads, with subclasses of compounds listed beneath them. Corresponding tables containing compound information and page numbers are listed.

Specific References for Tables of Properties

Hydrocarbon compounds are listed alphabetically for each table or group of tables, with the relevant properties listed in columns across the pages. A reference number (or numbers) is provided in each relevant column. The reference numbers refer to authors of relevant works as they are listed at the bottom of the pages. The

authors can then be consulted in the General References section to retrieve the relevant references.

General List of References

The references are listed alphabetically by first author's surname. When more than one reference work is listed for the author (or authors), each reference is numbered. These works are indicated in the Specific References as superscripts. Both published (e. g., journal articles and proceedings) and unpublished works are included in the General List. Since the journal titles are abbreviated, it may be necessary to consult a standard list of journal titles (e. g., World List of Scientific Periodical or the Chemical Abstracts Service Source Index) to ascertain the full title of the work.